Effects of dried sugar beet root based concentrates level on the performance of Nubian goat male kids

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ABSTRACT

Culled Nubian males are important for meat production in the Sudan, but nutrition is a main constraint. Sugar beet is recently introduced for sugar production in the Gezira State and is a valuable feed. *Seewa* is sorghum cobs residue with low nutritive value and could be supplemented to improve the nutritive value and animals performance. There is no information on using upgraded *Seewa* and dried sugar beet root (DSBR) based concentrates level on Nubian kids performance and carcass characteristics. Consequently, 12 Nubian male kids at 6 month old were used to furnish this vital information. They were weighed and allocated at random to three experimental feeds and housed in individual pens with feed and water trough. They were fed upgraded *Seewa* (UGS) *ad lib*. at 8 am and 4 pm and refusals were collected, weighed and stored for laboratory analysis. The animals were fed DSBR based concentrates at 0 (control), 250g and 500g in two meals before UGS. Samples of feeds and refusals were stored for laboratory analysis. The animals were allowed a two weeks preliminary period and weighed weekly for 8 weeks. Data were statistically analyzed using ANOVA. *Seewa* had low CP and high CF and upgrading increased CP. Mean upgraded *Seewa* DMI varied among concentrates levels, but not significant ($P>0.05$) and were highest in animals fed 250g concentrates and least in animals fed 500g concentrates. Mean total dry matter intake (TDMI) increased significantly ($P<0.05$) with concentrates level. Mean water intake, body weight (BW), weekly weight gain and feed conversion ratio (FCR) increased with concentrates level, but differences were not significant ($P<0.05$). It was recommended to use DSBR based concentrates and upgraded *Seewa* in fattening Nubian male kids.

INTRODUCTION

The increased meat demand and prices in the Sudan highlighted the need to produce high quality and cheap meat and exploit less utilized animal species for meat production. Sheep meat is the most preferred and goat meat is the least preferred and is mainly consumed as kids meat. Goat meat has low fat and cholesterol and high nutritive value and muscles (Casey, 1992). The demand for goat meat is increasing due to the disputed correlation between cardiovascular diseases and saturated fatty acids and cholesterol (Wikipedia, 2016). Goats are important in the Sudan due to high population, wide distribution and production of high quantities of high quality milk, meat and skin (MARF, 2011). Sudan ranked 6th in world goat population and meat production (FAOSTAT, 2008), but goats contribution is low related to their potentials. This was mainly because goat meat production is mainly traditional based on rangeland which deteriorated for many factors (Abusuwar and Darrag, 2002) and low inputs and outputs. Improving goat meat production will make it competitive and increase demands, exports, other types of meat exports and national income. There are many goat breeds in the country and the Nubian is the main dairy breed and other breeds are considered meat breeds (Devendra and Mc Leroy,1992). Nubian goat males are usually culled at early ages and could be used for meat production.

Nutrition is a main constraint for goat meat production in the Gezira State due to rangeland deterioration, seasonal variations in feeds quantity and quality with serious shortages and effects on animals health and performance, especially in the dry season (Hamed, 2007). Crop residues are important feed resources with generally low nutritive value and animals performance. It is important to improve the nutritive value of crop residues and utilize cheap feeds. *Seewa* is sorghum cobs residue and is abundant and cheap, but has low nutritive value and could be upgraded by different methods including supplementation. Dried Sugar beet roots (DSBR) based concentrates were used in fattening *Tagger* males in the Gezira State (Elshafie, 2016). However, there is no available information on exploitatimg upgraded *Seewa* and DSBR based concentrates in Nubian male kids meat production. Consequently, this study was proposed to study effects of different levels of DSBR based concentrates on the performance of Nubian male kids fed upgraded *Seewa ad lib*..

MATERIALS AND METHODS

The experiment was executed in the Goat Research Centre, Faculty of Agricultural Sciences, University of Gezira in Elnesasheba farm in Wad Medani, Gezira State, Sudan.

Animals

Twelve Nubian male kids at 5-6 month old were used in this study. They were purchased from *Elkaraiba* livestock market and transported by car to the Goat Research Centre premises. They were housed in an open corral shaded with corrugated iron, rested, fed and watered. They were injected with Intermectin (Interchemie Werken, Harjumaa, Estonia) against internal and external parasites.

Housing

The animals were housed in individual wire pens (1.5x2 m) in an open corral shaded with corrugated iron sheets. The pens had roughages, concentrates and drinking water buckets.

Feeds and feeding:

Sorghum *Seewa* was bought from *Elkaraiba* livestock market and upgraded with urea, molasses and groundnut cakes. Table 1 shows the ingredients of upgraded *Seewa*. Sun dried sugar beet roots

were bought from a farmer in Rahad Scheme, crushed in a mill and mixed with concentrates ingredients. Table 2 shows ingredients of the dried sugar beet roots (DSBR) based concentrates.

Table 1. The ingredients of upgraded *Seewa* fed to Nubian male kids in the Gezira State, Sudan.

Ingredients	%
Seewa	80
Groundnut cake	10
Urea	2
Molasses	5
Lime stone	2
Salt	1

Table 2. The ingredients of dried sugar beet roots (DSBR) based concentrates fed to Nubian males kids in the Gezira State, Sudan.

Ingredients	%
Dried sugar beet roots	70
Groundnut cakes	15
Sunflower cakes	15

The kids were weighed using a 100 kg hydrologic weighing machine manufactured by Salter, England, ranked according to BW and divided into three groups, each with four animals. The groups were allocated at random to three diets. The animals were then weighed weekly for 8 weeks including a 10 days preliminary period. The kids were fed upgraded *Seewa* (UGS) *ad lib*.. Pre weighed UGS was fed in two equal meals at 8.0 am and 4.0 pm and refusals were collected and weighed before the morning meal for each animal. Upgraded *Seewa* and refusals were sampled and stored in polyethylene bags for laboratory analysis. The kids were fed different levels of DSBR based concentrates (0 (control), 250g and 500g) in two equal parts before UGS meals. Samples of DSBR and concentrates were stored in polyethylene bags for laboratory analysis.

The kids were offered clean drinking water *ad lib*.. Water intake was measured for 7 days in the 4th week of the experiment. The animals were offered measured amounts of water in the morning and afternoon. Water intake was measured by difference and daily water intake was calculated by summing amounts consumed in the morning and afternoon.

Laboratory analysis

Feed samples were analyzed in triplicates for DM, CP, EE, CF and ash (AOAC, 1990).

Statistical analysis

Data were statistically analyzed using ANOVA procedure.

RESULTS

Feeds proximate analysis

The proximate analysis of feeds is shown in Table 3. Upgraded *Seewa* had higher CP, CF, EE and ash than *Seewa* and refusals. Concentrates level increased refusals NFE, ash and EE and decreased CF and CP.

Table 3. The proximate analysis (%) of feeds fed to Nubian male kids in the Gezira State, Sudan.

Feeds	DM	CP	CF	Ash	EE	NFE
DSBR	94.00±0.12	9.56±0.25	18.29±0.56	8.89±.07	1.20±0.17	62.06±.27
Concentrates	94.67±0.09	14.35±5.67	8.75±0.09	9.03±0.17	2.21±0.17	65.66±0.76
UGS	95.28±0.24	14.01±0.14	20.63±0.07	9.78±0.50	3.49±0.28	52.09±5.44
Seewa	95.33±0.34	2.51±0.13	50.00±0.11	14.04±0.09	1.39±0.46	32.06±0.89
UGSr1	95.17+0.17	8.22+0.22	40.29±0.36	11.62+0.01	2.99+0.22	36.88± 0.67
UGSr2	95.11±0.01	7.20±0.30	37.25±0.00	12.00±0.07	2.10±0.75	41.45±1.12
UGSr3	95.39±0.10	7.88±0.33	35.62±0.06	12.27±0.11	3.39±0.40	41.84±0.19

DSBR= Dried sugar beet roots; UGS= Upgraded *Seewa*; UGSr1= Upgraded *Seewa* refusals (0g concentrates, control), UGSr2= Upgraded *Seewa* refusals (250 g concentrates), UGSr3= Upgraded *Seewa* refusals (500g concentrates).

Water intake

Table 4 shows effects of DSBR based concentrates level on water intake. Water intake varied with days. Overall mean water intake generally decreased with days. Overall mean water intake increased with concentrates level, but not significantly ($P>0.05$). It was not significantly ($P>0.05$) affected by concentrates level in the 4th and 6th days. It was significantly ($P<0.05$) increased with concentrates level in the 5th day and decreased in the 7th day. Water intake was highest in animals fed no concentrates and least in animals fed 250g concentrates in the first 2 weeks. It was significantly ($P<0.05$) highest in animals fed 250 g concentrates and least in animals fed no concentrates in the 3rd day. In the 4th day it was highest in animals fed 500g concentrates and least in animals fed no concentrates. In the 6th day it was highest in animals fed 250g concentrates and least in animals fed no concentrates.

Table 4. Effects of dried sugar beet roots based concentrates level on water intake (Liters) in Nubian male kids fed upgraded *Seewa ad lib* in the Gezira State, Sudan.

Days	Concentrates level (g/day)			
	0	250	500	Mean
1	4.29±0.39	3.70±0.69	4.04±0.66	4.01±0.30
2	3.75±0.77	3.54±0.73	3.60±0.90	3.63±0.11
3	2.82±0.18	3.76±0.45	3.60±0.72	3.39±0.50
4	2.79±0.66	2.87±0.24	3.62±0.75	3.09±0.46
5	2.83±0.38	3.54±0.28	3.77±0.30	3.48±0.49[b]
6	2.94±0.67	3.35±0.79	3.16±0.55	3.15±0.21
7	2.59±0.31	2.12±0.37	2.02±0.21	2.24±0.30
Mean	3.14±0. 58	3.27±0.59	3.40±0.66	

Dry matter intake

Table 5 shows effects of DSBR based concentrates level on UGS dry matter intake in kids. Upgraded *Seewa* DMI generally decreased with concentrates level in all weeks, except the 3rd, 7th and 8th weeks where it generally increased and this effect was significant (P<0.05) in the 1st and 5th weeks. Mean weekly UGS dry matter intake varied with weeks and was highest in the 6th week and least in the 2nd week. Overall mean upgraded *Seewa* DMI decreased with concentrates levels, but not significantly (P>0.05).

Table 5. Effects of different levels of dried sugar beet root based concentrates on daily *Seewa* dry matter intake in Nubian kids fed upgraded *Seewa ad lib* in the Gezira State, Sudan.

Weeks	Concentrates level (g/day)			Mean
	0	250	500	
1	529.00±29.87	437.10±62.02	389.29±35.99	451.80±71.01
2	449.47±41.11	449.17±56.23	429.08±71.02	442.57±11.69
3	528.98±13.24	613.74±33.68	617.36±30.85	586.69±50.14
4	647.49±17.72	651.98±25.45	634.11±57.24	644.53±09.30
5	658.67±9.48	643.05±26.02	625.81±17.92	642.51±16.44
6	659.77±12.56	654.27±9.07	654.13±22.77	656.06±03.22
7	579.57±28.57	582.82±31.18	576.36±72.27	579.58±3.23
8	583.96±36.93	599.92±29.09	587.09±70.25	590.32±8.46
Mean	579.61±74.99	579.01±87.62	564.15±99.37	

Total dry matter intake

Table 6 shows that TDMI generally increased significantly (P<0.05) with concentrates level in all weeks. Weekly TDMI generally increased significantly (P<0.05) in all weeks. Overall mean TDMI increased significantly (P<0.05) with concentrates level.

Table 6. Effects of dried sugar beet roots based concentrates level on total dry matter intake in Nubian male kids fed upgrades *Seewa ad lib.* in the Gezira State, Sudan.

Weeks	Concentrates level (g/ day)			Mean
	0	250	500	
1	529.00±29.87	673.35±62.02	861.54±35.58	687.96±166.76
2	449.47±41.11	700.90±6.23	901.60±71.02	683.99±226.54
3	528.98±13.24	865.70±33.68	894.90±31.65	763.19±203.36
4	647.49±17.72	872.70±25.45	1106.60±57.24	875.60±229.57
5	658.67±9.48	891.60±26.02	819.70±17.92	789.99±119.27
6	659.77±12.56	901.60±9.07	912.31±22.77	824.56±142.82
7	579.57±28.57	1088.1±31.17	1127.3±72.27	931.66±305.55
8	583.96±36.93	1058±29.09	1090.60±70.25	910.85±283.57
Mean	579.61±74.99	881.50±146.68	964.32±122.88	

Weekly body weight

Table 7 shows effects of dried sugar beet roots based concentrates level on weekly BW in kids. Body weight increased with weeks in all treatments. Overall mean weekly BW increased with weeks. Body weight increased with concentrates level in all weeks. The increased BW was not significant (P≥0.05) up to the 5th week and was significant (P≤0.05) after that. Overall mean concentrates BW increased with concentrates level.

Table 7. Effects of different levels of dried sugar beet root based concentrates on weekly body weight in Nubian male kids fed upgraded *Seewa ad lib.* in the Gezira State, Sudan.

Weeks	Concentrates level (g/ day)			Mean
	0	250	500	
1	11.38±0.63	11 .81±1.89	12.93±2.30	12.04±0.80
2	12.63±0.50	14.37±1.43	14.62±2.50	13.87±1.08
3	13.00±0.50	14.50±1.25	14.88±2.43	14.13±0.99
4	13.00±0.50	15.25±1.63	15.12±2.50	14.46±1.26
5	13.75±0.61	15.75±1.47	17.75±2.32	15.75±2.00
6	13.75±0.82	16.63±1.26	17.75±2.56	16.04±2.06
7	15.13±0.71	17.00±1.31	16.50±2.65	16.21±0.97
8	14.50±0.78	17.25±1.38	17.68±2.44	16.48±1.73
Mean	13.39±1.16	15.82±1.17	15.90±1.79	

Weight gain

Table 8 shows effects of DSBRbased concentrates level on weekly weight gain in kids. Weekly weight gain varied among weeks in all treatments. In the control it was highest in the1st week and least in the 3rd week. In animals fed 250g concentrates it was highest in the1st week and least in the

2nd and 3rd weeks. In animals fed 500g concentrates, it was highest in the 5th week and least in the 2nd week. Weekly weight gain generally increased with concentrates level in the 1st, 3rd, 5th and 6th weeks and generally decreased in the 2nd, 4th and 7th weeks. Weekly weight gain was highest in the 2nd and 4th weeks in the control, the 1st, 3rd and 6th weeks in animals fed 250g and the 5th and7th weeks in animals fed 500g. Concentrates level had no significant effect (P>0.05) on weight gain in all weeks, except the 5th week. Overall mean weekly weight gain increased with concentrates level.

Table 8. Effects of dried sugar beet roots based concentrates level on weekly weight gain in Nubian male kids fed upgrades *Seewa ad lib.* in the Gezira State, Sudan.

Weeks	Concentrates level (g/day)			Mean
	0	250	500	
1	1.25±0.91	2.13±1.11	1.69±0.37	1.69±0.44
2	0.50±0.25	0.13±0.14	0.25±0.29	0.29±0.19
3	0.13±0.25	0.13±0.65	0.38±0.25	0.21±0.14
4	0.56±0.31	0.50±0.41	0.38±0.25	0.48±0.09
5	0.38±0.32	0.88±0.31	1.94±1.20	1.07±0.80
6	0.50±0.41	0.81±0.61	0.63±0.38	0.65±0.16
7	0.63±0.66	0.37±0.43	0.44±0.80	0.48±0.14
Mean	0.56±0.34	0.71±0.69	0.82±0.70	

Feed conversion ratio

Feed conversion ratio increaed with concentrates level and was almost similar in the control and animals fed 250g concentates. It was 8.28, 8.29 and 9.52 at 0, 250 and 500g dried sugar beet roots based concentrates, respectively.

DISCUSSION

Upgraded *Seewa* refusals generally had lower proximate analysis values because animals selected better feeds part as reported in goats (Elimam *et al*., 2003; Ahmed, 2014; Elshafie, 2016). The generally refusals lower CP and EE and higher CF with concentrates level confirmed that for BSBR based concentrates level in goats (Elshafie, 2016). Dried sugar beet roots proximate anlysis varied from that in the Gezira State (Elshafie, 2016) and could be mainly genetic and/ or environmental.

The variations in overall mean upgraded *Seewa* DMI among concentrates levels were mainly due to effects of concentrates level on rumen fermentation, digestibility and rates of outflow. The highest DMI in animals fed 250 g concentrates suggested that it had the optimum effects on rumen fermentation, digestibility and rates of outflow as concentrates improved rumen outflow rates, total VFA and hemicellulose and lignin digestion in sheep (Kennedy, 1992). The least DMI in animals fed 500g concentrates could be because N was limiting at this level or due to high rumen fill at the highest concentrates level. Daily and weekly variations in DMI were reported in *Tagger* males fed DSBR based concentrates (Elshafie, 2016) and does fed sorghum stover and pods (Ahmed, 2014) and were mainly environmental.

The significantly increased TDMI in all weeks and overall mean TDMI with concentrates level was mainly due to improved rumen fermentation. Nubian males DMI was higher than Nubian goats fed sorghum stover (Hamed, 2007) and lower than *Tagger* males fed different levels of DSBR based concentrates.

The increased overall mean water intake with concentrates level was associated with increased TDMI. Nubian males water intake was within the range in Nubian goats fed *Raba* ash alkali treated sorghum stover (Hamed, 2007). It was within the range for *Tagger* does fed *Lukh* and pods (Ahmed, 2014).

The increased BW with weeks was mainly due to age as found in *Tagger* males fed DSBR based concentrates (Elshafie, 2016) and grain based concentrates (Elimam *et al*., 2010). The increased weekly and overall mean BW with concentrates level was mainly due to improved nutrients supply, rumen fermentation, digestibility and weight gain as concentrates increased rumen outflow rates, total VFA and hemicellulose and lignin digestion in sheep (Kennedy, 1992) and digestibility (Dessie *et al.*, 2009). *Tagger* males overall BW increased with DSBR based concentrates level (Elshafie, 2016).

The increased overall mean weekly weight gain with concentrates level was also found in *Tagger* males fed DSBR based concentrates (Elshafie, 2016). This was mainly due to improved nutrients supply, rumen fermentation, feed digestibility and increased BW. The least weight gain in animals fed no concentrates was due to low nutritive value and feed intake (Kennedy, 1992; Dessie *et al.*, 2009). Nubian males weight gain was within the range in *Tagger* males fed DSBR based concentrates (Elshafie, 2016) and grain based concentrates (Elimam *et al.*, 2010).

The weekly variations in FCR were associated with variations in DMI and weight gain. The increased FCR with concentrates level was not expected, as concentates were expected to improve rumen environment, fermentation, feeds nutritive value, rates of outflow, DMI and weight gain. The close FCR values in the control and animals fed 250g concentate showed that upgraded *Seewa* was satisfactory.

CONCLUSION

Dried sugar beet root based concentrates improved Nubian male kids overall mean TDMI, BW, water intake and weekly weight gain.

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أثر المستويات المختلفة لعلف مركز يحتوي على بنجر السكر المجفف علي أداء جديان ذكور الماعز النوبي

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الخلاصة

ذكور الماعز النوبي المستبعدة من القطيع هامة لإنتاج اللحوم في السودان الا أن التغذية عائق رئيسي. تم مؤخرا إدخال زراعة بنجرالسكر لإنتاج السكر في ولاية الجزيرة و هو علف قيم. السيوة هي مخلفات قندول الذرة الرفيعة مع إنخفاض القيمة الغذائية ويمكن دعمها لتحسين القيمة الغذائية وأداء الحيوانات. لا توجد معلومات عن استخدام السيوة المحسنة وأثر مستوى عليقة مركزة ترتكز على جذر بنجر السكر المجفف علي أداء جديان ذكور الماعز النوبي وصفات الذبيحة. لذلك إستخدمت 12 ذكراً من الماعز النوبي بعمر خمسه أشهر لتوفير هذه المعلومات الضرورية. وزنت الحيوانات وتم توزيعها عشوائياً لثلاثة مجموعات وخضعت لثلاثة أعلاف بصورة عشوائية كاملة ووضعت في حظائر مفردة بها معالف وشرابات. غذيت الحيوانات بمخلفات قناديل الذرة المحسنة حسب الرغبة عند الساعه الثامنة صباحاً والرابعة مساءاً وجمعت مخلفاتها ووزنت وحفظت لتحليلها في المعمل. كما تمت تغذية الحيوانات بالعلف المركز عند صفر (الشاهد) و250 جرام و500 جرام في وجبتين قبل مخلفات قناديل الذرة المحسنة. عينات الأعلاف والمخلفات تم حفظها لتحليلها في المعمل. وزنت الحيوانات أسبوعياً لفترة ثمانية أسابيع مع أسبوعين فترة تمهيدية. تم تحليل البيانات إحصائياً بالأنوفا. تميزت السيوة بنسب بروتين منخفضة ونسب الياف خام مرتفعة وزاد التحسين نسب البروتين. إختلفت الكميات الكلية للمادة الجافة المأكولة من مخلفات قناديل الذرة المحسنة بين مستويات العليقة المركزة ولكن ليس بشكل معنوي وكان عالياً في الحيوانات التي غذيت علي 250 جرام من العليقة المركزة وأقل في الحيوانات التي غذيت علي 500 جرام من العليقة. زاد المتوسط الكلي لكمية العلف المأكولة على أساس الوزن الجاف زاد بشكل معنوي مع مستوى العليقة المركزة. زاد متوسط استهلاك الماء ووزن الحيوانات والوزن المكتسب اسبوعيا و كفاءة استغلال العلف مع مستوى العليقة المركزة بشكل غير معنوي. يوصي بإستخدام جذور بنجر السكر المجففة مع قناديل الذرة المحسنة لتسمين ذكور الماعز النوبي.